USGS Water Availability and Use Pilot: Great Lakes and Western Basins

Joint USGS -- USACOE Meeting
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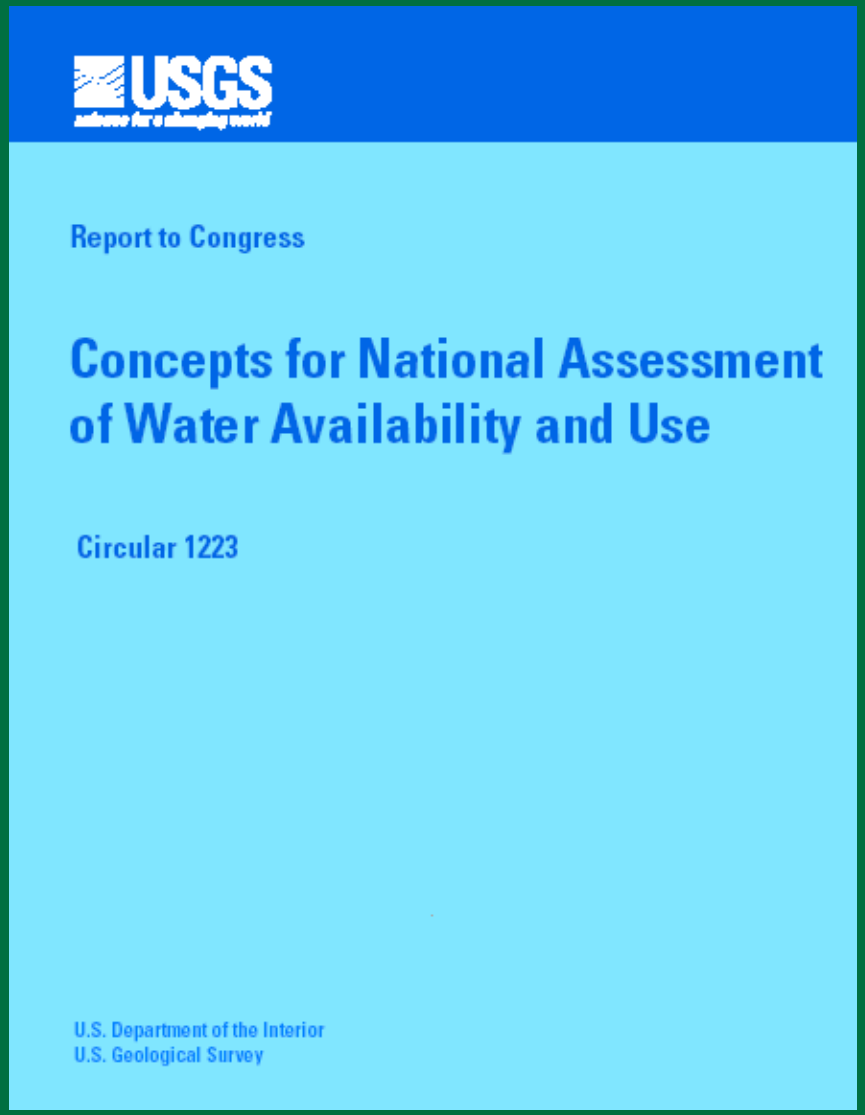
Kevin F. Dennehy--Coordinator, Ground-Water Resources Program

U.S. Department of the Interior
U.S. Geological Survey

National Assessment of Water Availability and Use

- In 2002, USGS was directed to prepare a report describing the efforts needed to provide periodic assessments of the status and trends in the availability and use of fresh water resources

  - U.S. Geological Survey (2002) Report to Congress - Concepts for National Assessment of Water Availability and Use: U.S. Geological Survey Circular 1223, 34 p. (http://water.usgs.gov/pubs/circ/circ1223/)



Great Lakes Basin Pilot

- **Funded in 2005**
- **Develop methods for National Program**
- **Provide information for Great Lakes Charter Annex 2001**
- **Respond to Great Lak issues**

Image from NOAA, Great Lakes Environmental Research Laboratory, AVHRR satellite imagery, 1995.

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What is meant by

Water Availability?

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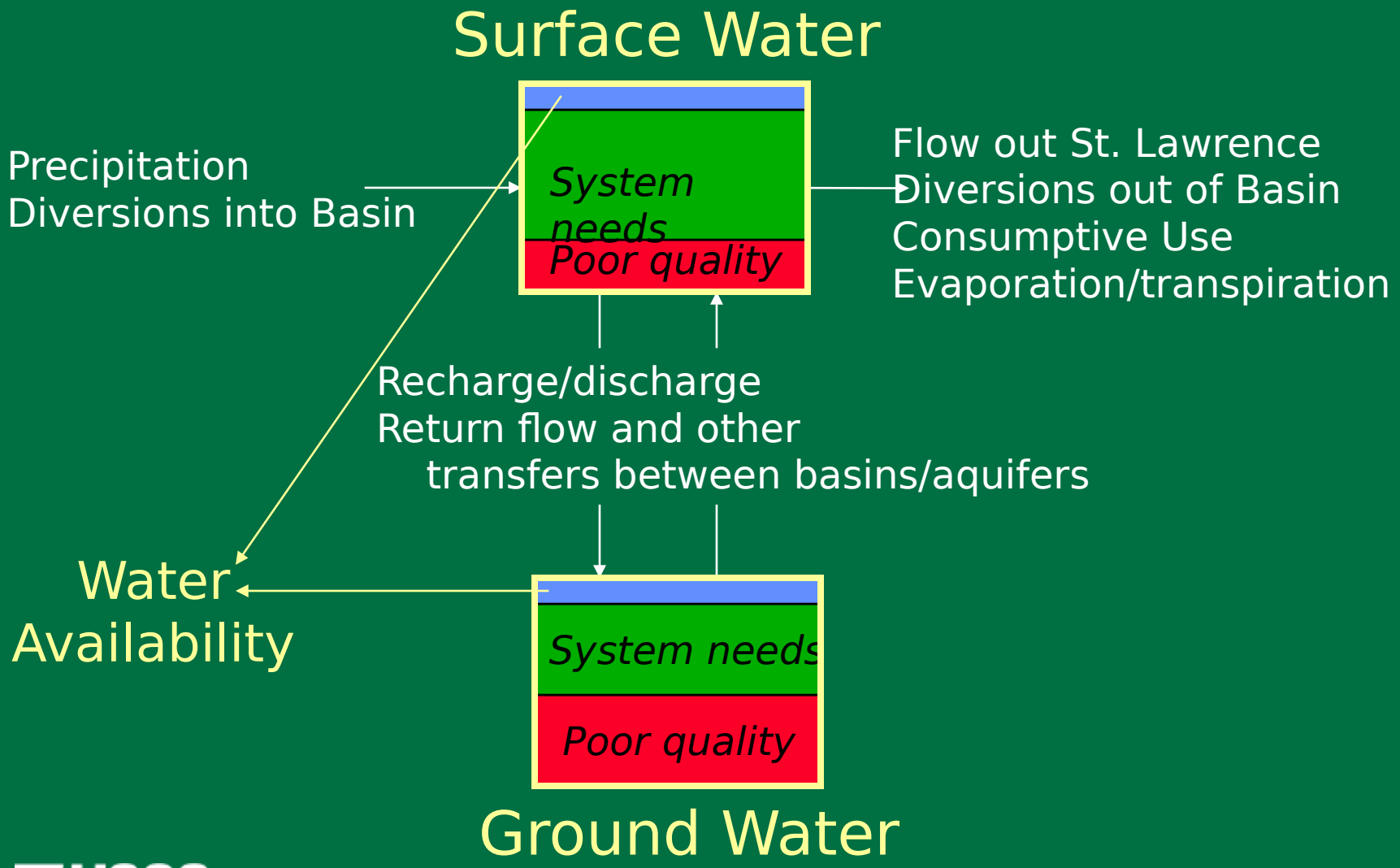
Schematic of Water Availability



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Water Availability

- Water flux and storage
  - Indicators for amount of water
    - SW—streamflows and lake levels
    - GW—levels, storage, divides
  - Indicators for dynamics of system
- Water Use
  - Account for current water use
  - Consumptive use vs. return flow
  - Diversions: both within-basin and out-of-basin
- Indicators
  - Develop or apply indicators that aggregate water flux, storage, and use

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- Ecological or system requirements
  - Maintain in-stream flow and flow dynamics
  - Maintain ground-water levels for wetlands
  - Maintain ground-water levels to limit intrusion of poor-quality water
  - Indicators?
- Water quality limitations
  - Natural and anthropogenic

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Surface-Water Flux and Storage

- Develop new techniques to estimate streamflow characteristics - use gage data to predict flow for ungaged basins
- Examine long-term trends in streamflow records
- Summarize historical Great Lakes water levels and relate to storage in system
- Develop reporting of monthly flows/conditions

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The U.S. Great Lakes Region showing numbered hydrologic subregions and locations of USGS Gaging Stations in Michigan.

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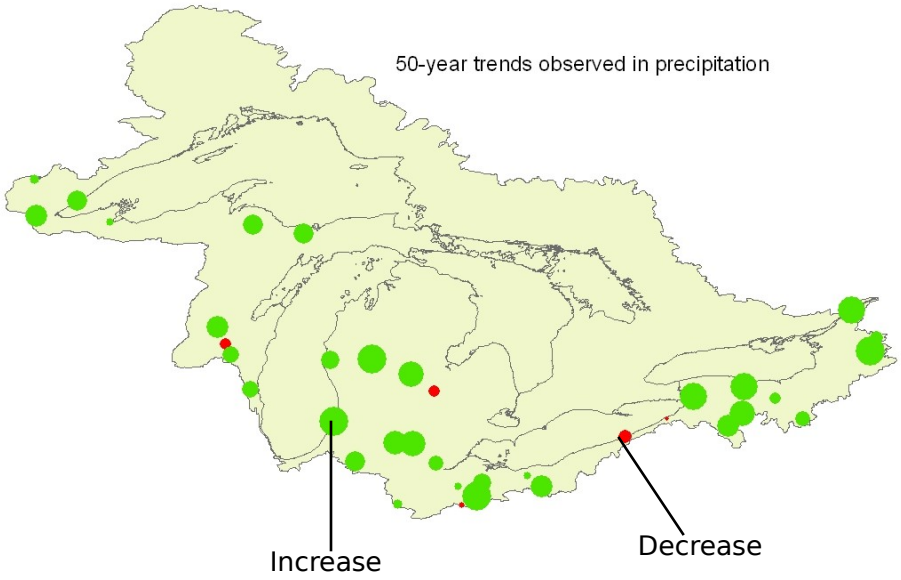
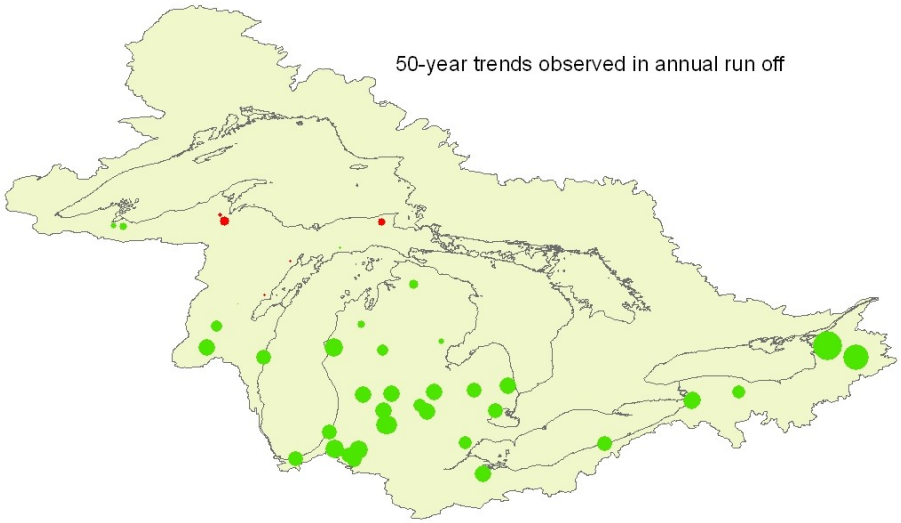
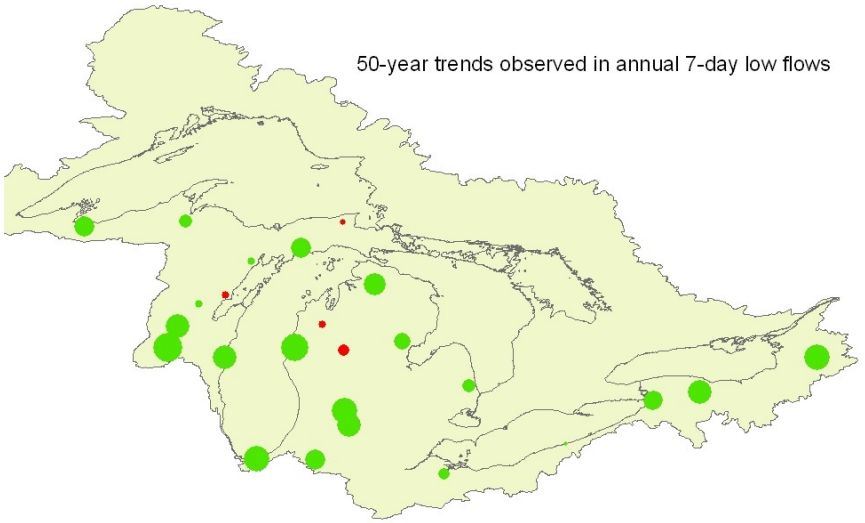
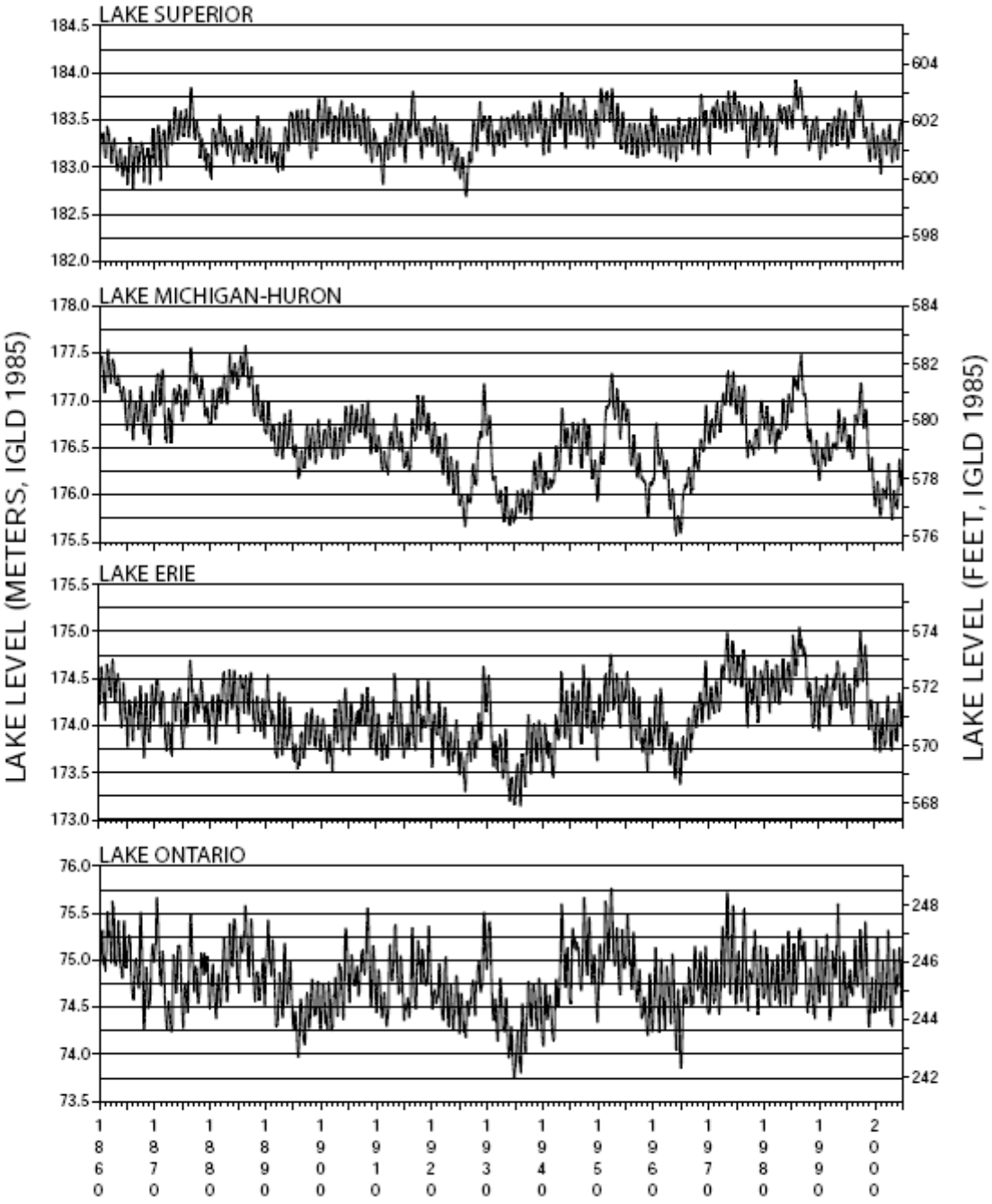
50-Year Trend Analysis

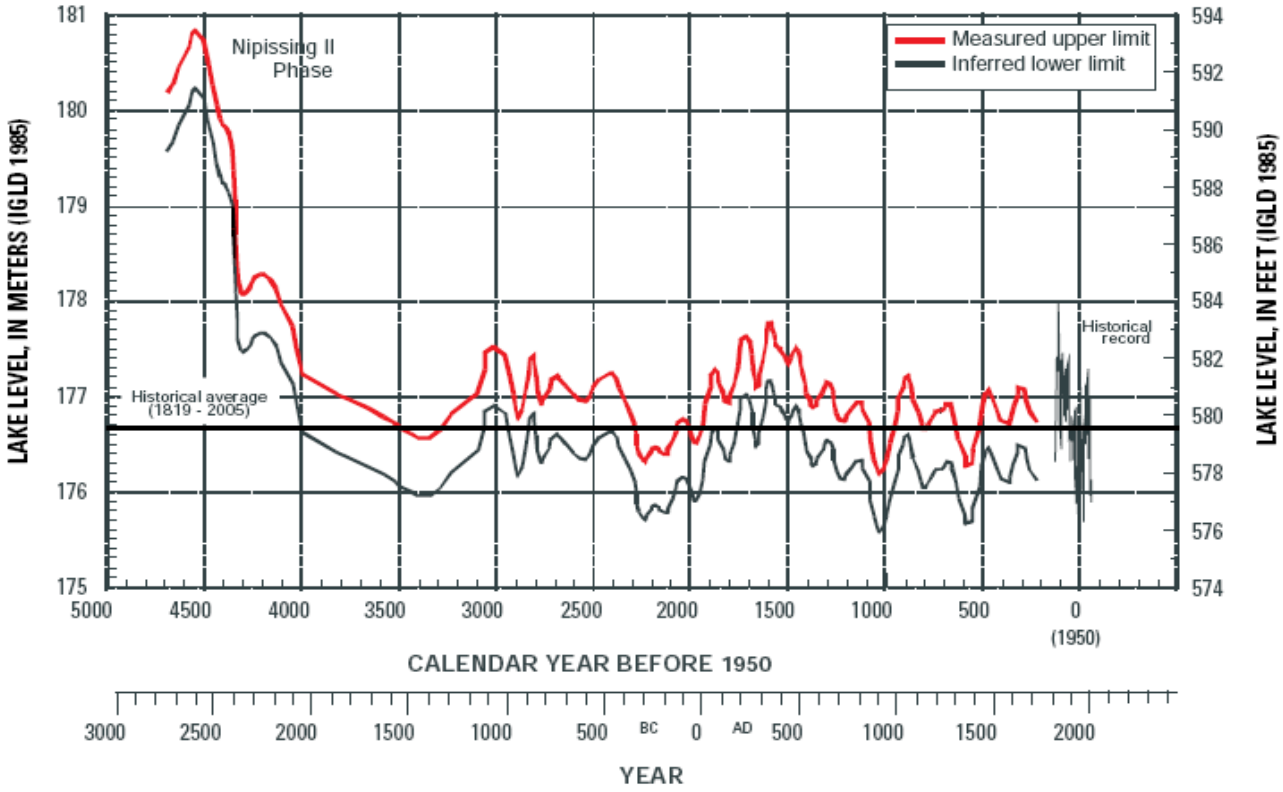








Observed Great Lakes Levels



Hydrograph of late Holocene lake level and historical lake level for Lakes Michigan and Huron. The red line is interpreted from beach-ridge studies, whereas the lower black line is an inferred lower limit using range of the historical record as a guide.

Vibracoring at Negwegon State park, Michigan. Vibracoring is an important tool needed to understand the subsurface geology of coastal systems throughout the Great Lakes.

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Ground-Water Flux and Storage

- Using est. of hydrogeologic properties of sediments and ground-water levels, develop estimate of fresh ground-water in storage.
- Develop understanding ground-water divides and the potential dynamics of these divides.
- Estimate the spatial variability in recharge for the Great Lakes Basin.
- Develop a numerical gw model for the contributing area to Lake Michigan that will aid in evaluating current and future water availability and use.

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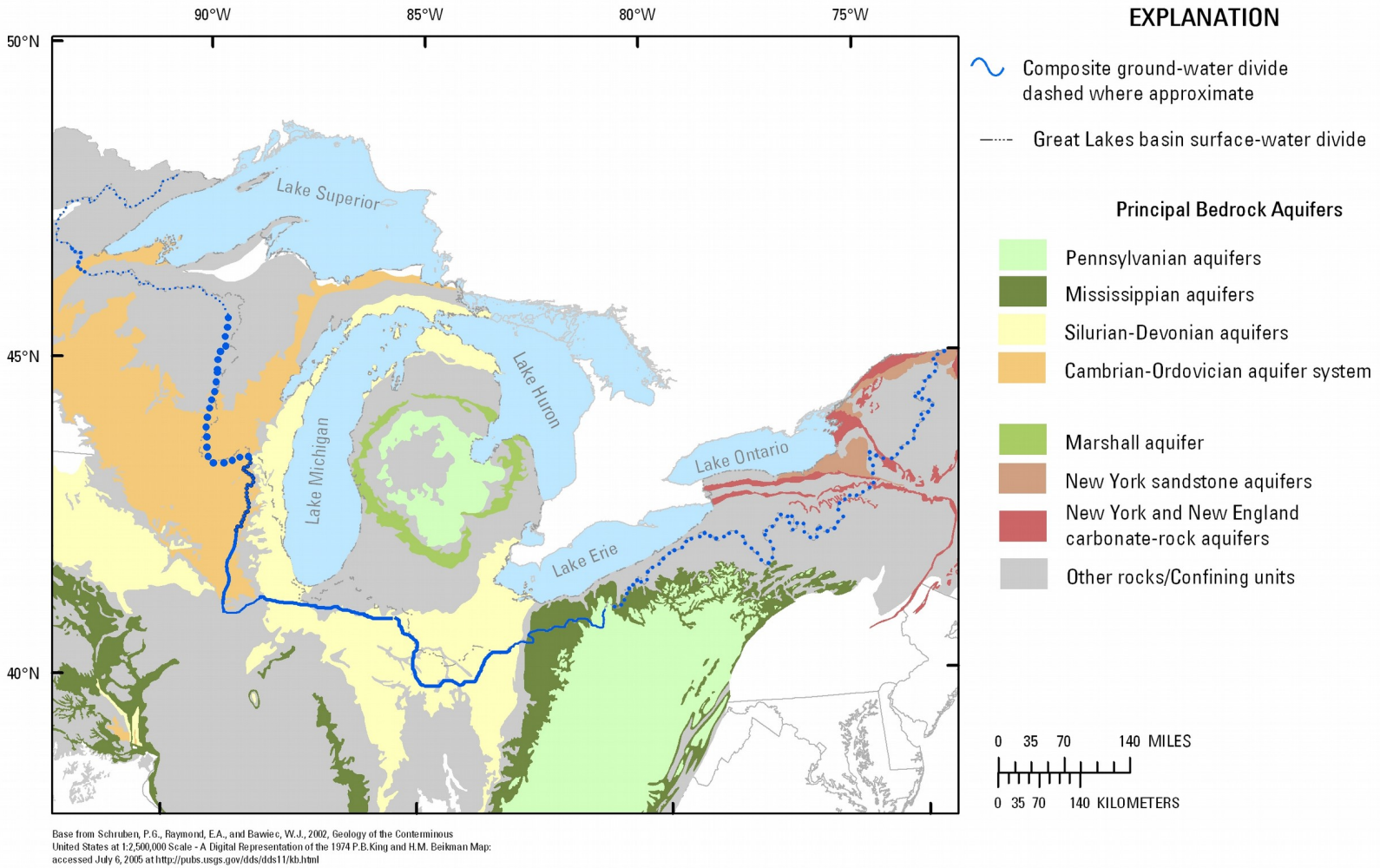
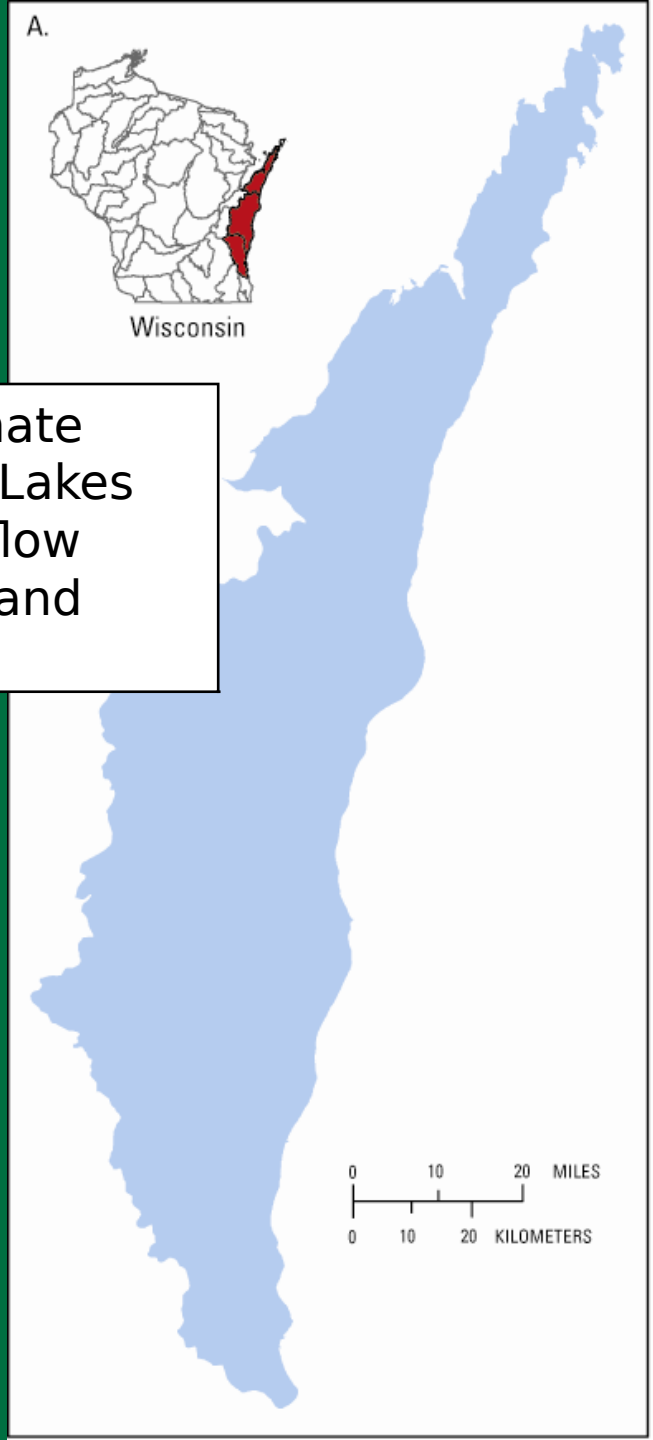


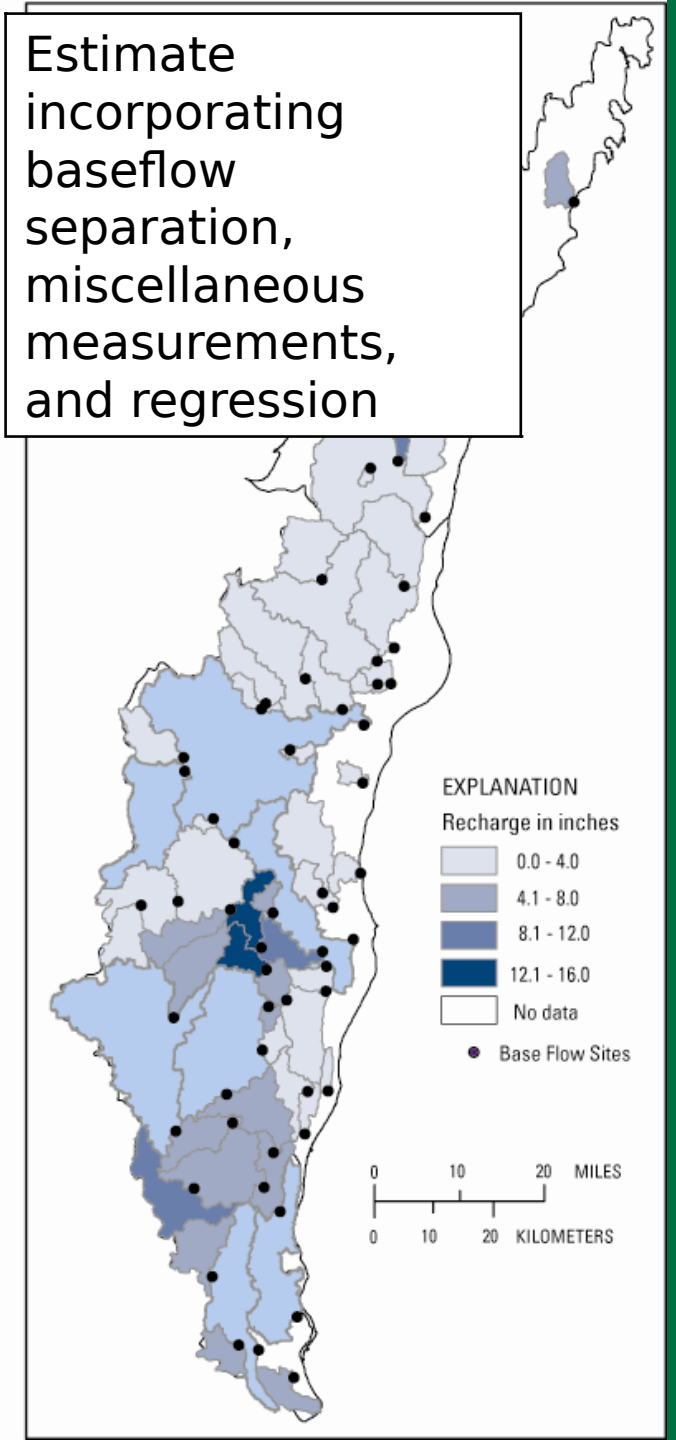
Base from Schruben, P.G., Raymond, E.A., and Bawiec, W.J., 2002, Geology of the Conterminous United States at 1:2,500,000 Scale - A Digital Representation of the 1974 P.B.King and H.M. Beikman Map: accessed July 6, 2005 at http://pubs.usgs.gov/dds/dds11/kb.html

Composite ground-water divide for the principal aquifers in the Great Lakes basin, United States.

HUC8 estimate from Great Lakes Basin baseflow separation and regression



Estimate incorporating baseflow separation, miscellaneous measurements, and regression



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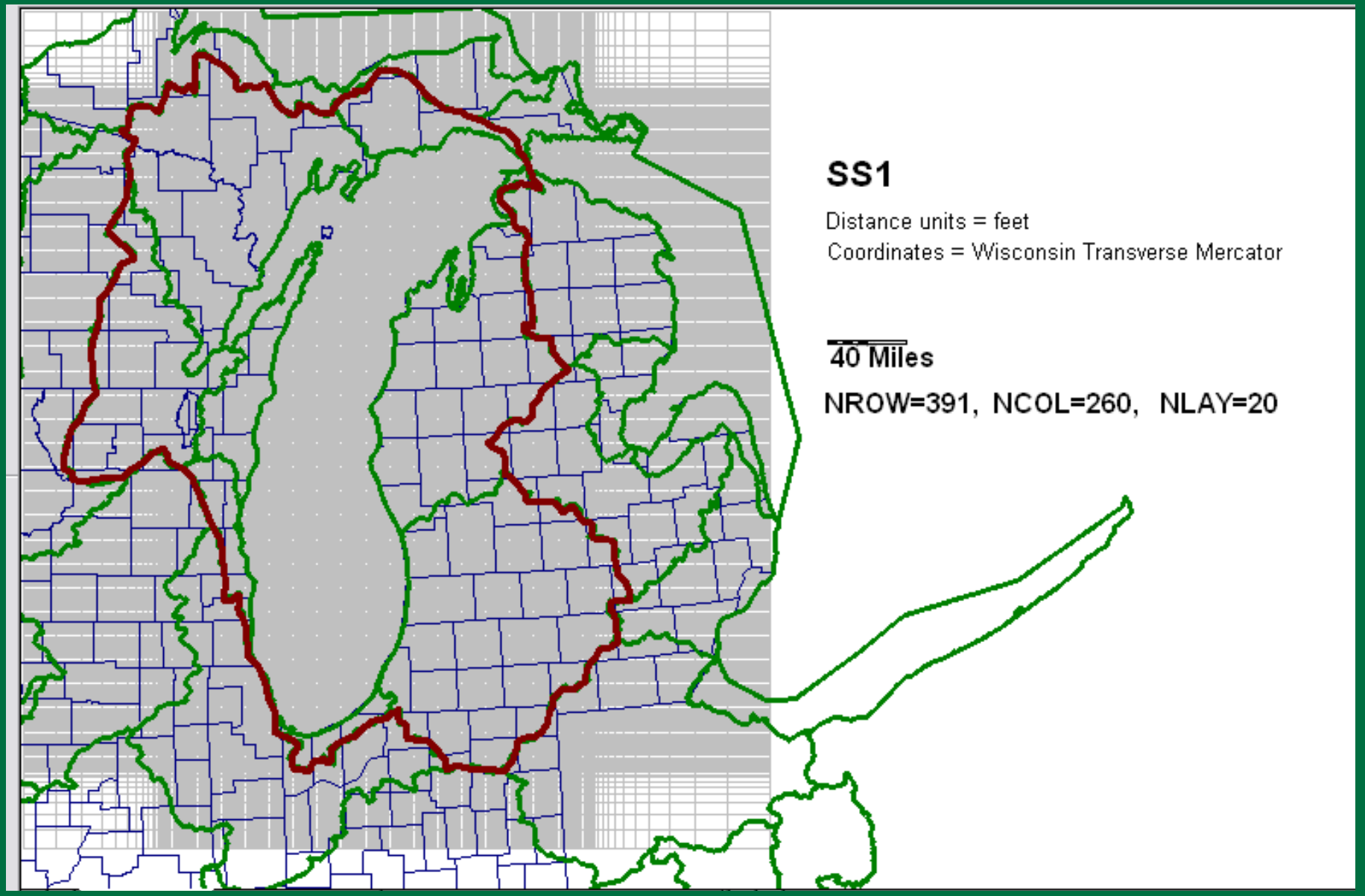
Ground-Water Flow Model



Water Use Components

- Review and assessment of consumptive use coefficients—crops, industry, and municipal
- Compilation and report summarizing Great Lakes regional water use by HUC
- Provide historical and current water use for ground-water flow model
- Improve estimates of consumptive use in a Ohio sub area by computing short-term estimates (monthly/seasonal) for public supply

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Publications

Coon, W.F., and Sheets, R.A., 2006, Estimate of ground water in storage in the Great Lakes Basin, United States, 2006: U.S. Geological Survey Scientific Investigations Reports 2006-5180, 19 p.

Feinstein, D.T., Haitjema, H., and Hunt, R.J., 2006, Towards more accurate leakage and conjunctive use simulations – A coupled GFLOW-MODFLOW application: Modflow and More 2006 – Managing Ground-Water Systems, May 22-24, 2006, Golden, Colorado.

Grannemann, N.G. and Reeves, H.W., 2005, Great Lakes Basin Water Availability and Use – A study of the National Water Availability and Water Use Program: U.S. Geological Survey Fact Sheet 2005-3113, 4 p. (http://pubs.usgs.gov/fs/2005/3113/pdf/FS2005_3113.pdf).

Hodgkins, G.A., Dudley, R.W., and Aichele, S.S., 2006, Historical trends in streamflow and precipitation in the U.S. Great Lakes Basin: U.S. Geological Survey Scientific Investigations Report, (in review).

Neff, B.P., Piggott, A.R., and Sheets, R.A., 2006, Estimation of shallow ground-water recharge in the Great Lakes basin: U.S. Geological Survey Scientific Investigations Report 2005-5284, 31 p. (http://pubs.usgs.gov/sir/2005/5284/)

Sheets, R.A., and Simonson, L.A., 2006, Compilation of regional ground-water divides for principal aquifers corresponding to the Great Lakes basin, United States: U.S. Geological Survey Scientific Investigations Report 2006-5102, 23 p.

Wilcox, D.A., Thompson, T.A., Booth, R.K., and Nicholas, J.R., 2006, Lake-level variability and water availability in the Great Lakes: U.S. Geological Survey Circular, (in review).

WATER AVAILABILITY METHODS DEVELOPMENT PROJECT— Lower Colorado River Basin

OBJECTIVE

Assess the ground-water availability and current conditions in the Lower Colorado River Basin. A special emphasis of the project is on development of methods of assessment and display of ground-water conditions that might be extended to other regions of the country.

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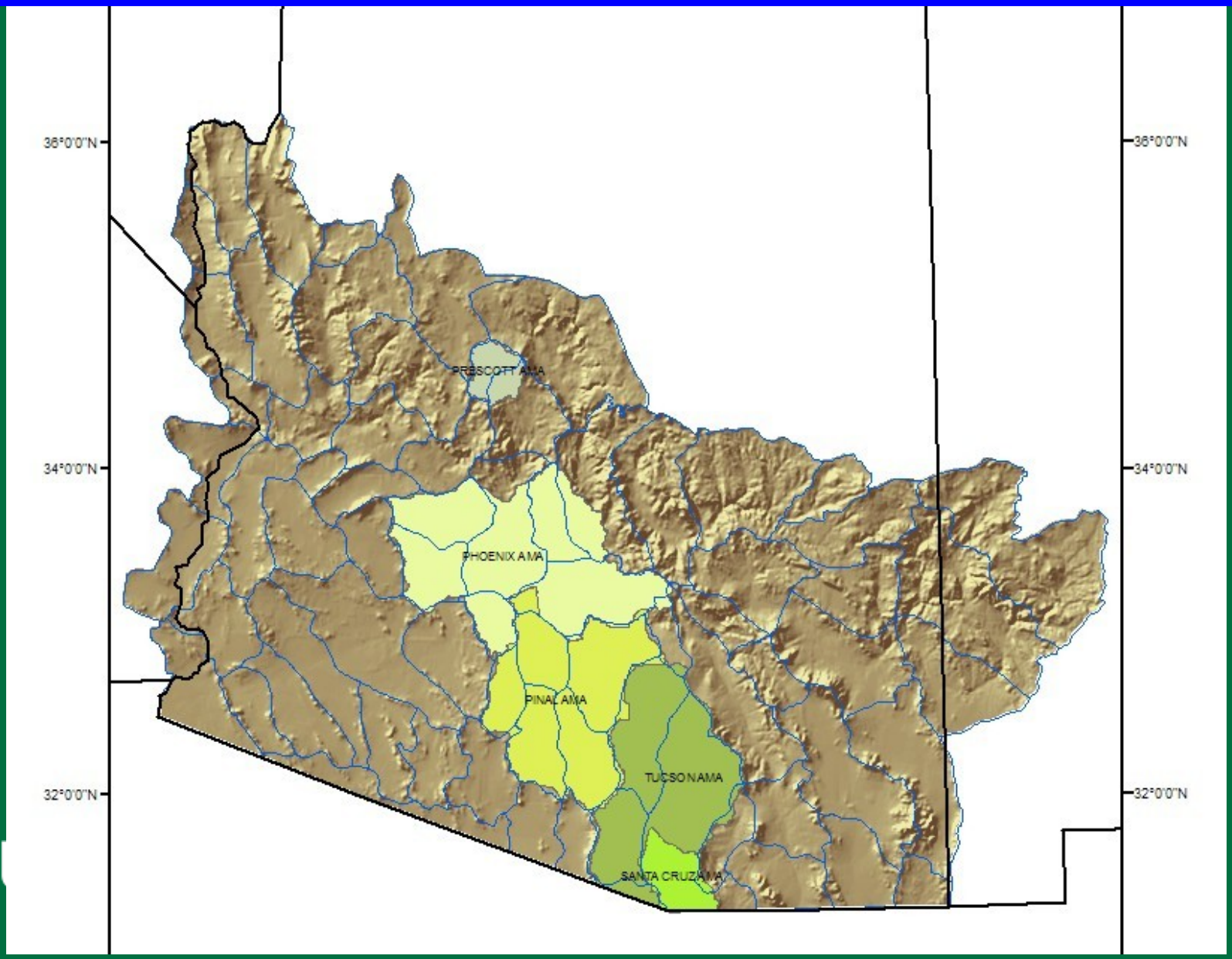
WATER AVAILABILITY PROJECT—
Lower Colorado River Basin



CURRENT USGS ACTIVITIES IN GREAT LAKES REGION

- **Western Lake Erie Basin Partnership**
  - **New--Just beginning (FY07-08)--Upper Auglaize study**
  - **POC--Jim Morris, Director, OH WSC**

- **Grassy Island Disposal Facility**
  - **USGS assisted FWS in different capacities —technical support such as development of sampling plan (sediment and hydrology).**
  - **POC--Jim Nicholas, Director, Michigan WSC**

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AREAS OF POTENTIAL COLLABORATION

- **Aquatic Habitat Restoration**
  - **USACE Great Lakes Wetlands and Habitat Proposal (USGS to assist in identification, prioritization, and implementation of actions, especially Huron-Erie Corridor).**
  - **POC--Leon Carl—Director, USGS Great Lakes Science Center**
- **SW Flow and Sediment Transport Modeling**
  - **Lake Huron-Erie Corridor—upgrade current model from 2-D to 3-D. Especially important for understanding erosion in St. Clair River channel.**
  - **POC—Jim Nicholas, Director, Michigan WSC**

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FOR MORE INFORMATION

- Howard Reeves, Project Chief, USGS Great Lakes Water Availability and Use Pilot Study, hwreeves@usgs.gov, 517-887-8914

- Norm Grannemann—USGS Coordinator, Great Lakes Focus Area, nggranne@usgs.gov, 517-887-8936

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